In this issue:

London Branch News – Pages 4-6
Corrosion Matters Workshop – Pages 12-13
Technical Article – Pages 14-17
Company News – Pages 18-19
Rustrol® Cathodic Isolator® effectively blocks the DC current needed for cathodic protection, while providing a grounding path for:

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CONTENTS

Institute News

The President Writes ........................................... 4
London Branch News .......................................... 4-6
Technical Topics ................................................ 7
ICorr Aberdeen Branch Meeting ............................... 8
ICorr Job Board .................................................. 9
Corrosion Matters Workshop ................................. 10-11
Welcome to New Members .................................... 12
New Sustaining Member - PPC Ltd ......................... 12

Technical Article

Internal Cathodic Protection of Offshore Wind
Turbine Monopile Foundations ............................... 14-17

Company News

Belzona Polymerics Limited ................................. 18-19

Sustaining Members ............................................. 20-27

ICATS Registered Companies ............................... 28-31

Diary and Branch Contacts ................................. 32
The President Writes

2015 is upon us and I would like to take this opportunity to wish you all a happy and successful year. The early days of this year are already having their effect on the corrosion industry as oil prices continue to fall and potentially cause planned corrosion protection projects to at least be reconsidered if not cancelled.

The Christmas period was notable for the invitation my wife and I received from London Branch to attend the Christmas Lunch at the Royal Over-Seas League near Green Park back in December. As always, the hospitality was good and I believe that this event was the largest Christmas Lunch on record. The after-lunch speaker was extremely entertaining and being a serving Policeman he had a wealth of “true” stories which he delivered with great humour.

However, the first quarter of the year is always a busy period for me with two trips to the USA planned for this year, at the end of January and again in March. The first trip takes in two locations, both with significance to ICorr. I travel to New York for the regular ASTM meetings of the D01 Committee on Paint and Related Coatings, Materials, and Applications.

These meetings deal with the creation and revision of ASTM standards on paint testing and several of these test methods have relevance to the ICorr Painting and Coating Inspection Courses provided by ARL and Corrodere.

The second location is Las Vegas for the SSPC Conference 2015, where there are two papers that I will be presenting; one on the difficulties of achieving dry film thickness specifications and the other on optimising the technique for pull-off adhesion testing. The DFT paper is based on the technical article reproduced in the May/June issue of Corrosion Management last year and I am very proud to say that Raouf Kattan and I have won the SSPC President’s prize for this paper.

At the SSPC event I will be representing ICorr as I have been asked to meet the SSPC Board and tell them about the Institute of Corrosion and its work. I see this as an excellent opportunity to establish a working relationship with an organisation that is very active in the protective coating industry and therefore has some shared interests with ICorr.

The second trip will be to Dallas in March for the NACE 2015 Corrosion Conference, where again there are two papers to be presented. This time on surface salt determination and a novel dry film thickness gauge for use in marine coatings.

At NACE I will be spending as much time representing ICorr as doing my day job. The President of ICorr has been welcomed by NACE in the past and I anticipate that this hospitality to be extended again this year.

Closer to home, the group which organised last year’s conference held in London are again busy working on the 2015 two-day conference to be held on 10th and 11th June 2015. The title of this conference is “Knowledge Transfer – Corrosion Matters Workshop” and the programme looks to be of great interest.

For my part, I am booked for the 12th March to give a presentation at the London Branch AGM and there is an initiative in hand to reconstitute Yorkshire Branch with the possibility of a meeting in May.

2015 looks like it will be a busy year for ICorr and I hope to be able to start planning my visits to as many of the branches as I can this year.

John Fletcher
President of the Institute of Corrosion

LONDON BRANCH NEWS

‘YEP 2013 DELEGATE’ BECOMES CONSUMMATE PROFESSIONAL

Under the chairmanship of Jim Glynn, the London Branch held their joint meeting with the London Branch of The Welding Institute (TWI) on 13th November at The Naval Club, Mayfair.

The 60-strong audience was treated to a comprehensive presentation by Kabir Raheem on the Effect of corrosion films in CO2 environments, on the corrosion of carbon steel pipelines under erosion/corrosion conditions’

Kabir started his engineering career at Wood Group Kenny in 2012, after gaining a degree in Oilfield Corrosion Engineering at University of Leeds in 2011. He joined the ICorr, Young Engineers Program (YEP) in 2013, completed the course and helped deliver, at The Royal Overseas Club in November 2013, a well-received solution to the case study ‘Fallout from Subsea Failures for Dissimilar Welds’.

Kabir said “the YEP course helped me to understand other aspects of engineering that I am not schooled in and it gave me a much more rounded picture of the requirements for projects and it was free”. Exactly one year later Kabir has made his London Branch presentation.

During the presentation, Kabir explained that under CO2 environments various films could be formed in carbon steel pipelines of either iron carbonate or iron carbide or a combination of both these constituents. The judgement to be made during the design process was how to predict the protective nature of these films.

To complicate the issue, where solids were present in the produced fluid, erosion of these films could occur and their protective nature put further in doubt. Kabir identified some 20 different published corrosion models to be used for such predictions and explained that it was difficult if not impossible, to choose the most accurate model for any one case. In many instances this led to either over or under design of the piping. He detailed the research that had been completed to date, the results and the possible permutations that affect the protective nature of any films formed under
erosion conditions. It proved a thought-provoking subject, which had more questions from the floor than the Chair could handle.

The very successful evening was brought to a close with a vote of thanks from Branch Committee member David Mobbs and presentation of a small gift to Kabir by Alan Denney of TWI; after which, all enjoyed the traditional hospitality of the London Branch.

The next Branch technical meeting will be on 8th January 2015, where David Deacon of Steel Protection Consultancy will make a presentation on 'Iconic London Structures - Their Protection and Maintenance'. All are welcome at The Naval Club, 38 Hill Street London, at 17.45 for a 18.15 start. Please note that The Naval Club requires gentlemen to wear jacket and tie when attending evening meetings.

LONDON BRANCH NEWS
SUCCESSFUL LUNCHEON

In accordance with tradition, on 11th December 2014, London Branch held their 26th Christmas Luncheon at the prestigious premises of The Royal Overseas League, in the heart of St James's. Over 175 hosts and guests created an excellent attendance and all enjoyed the opportunity to discuss the trials and tribulations occurring in the corrosion world in a convivial atmosphere and over an excellent lunch; the good health of the industry was confirmed in numerous conversations.

Branch Chairman John O’Shea deftly guided proceedings, presenting engraved tankards to Mike Moffat and Mike Allen for services to the Branch, as well as awarding the lavish raffle prizes to the lucky winners. Among the Chairman’s guests were the new President of the Institute, John Fletcher and the three sons of the late Fred Palmer, Stephen, Geoffrey and Michael. On behalf of the committee, Past President, David Deacon spoke fondly of the contribution made by Fred to the success of the Branch and the Institute and made presentations of framed mementos to each of Fred’s sons.

To bring the event to a finale, the guest speaker, Mr Alfie Moore, a serving sergeant with the Humberside Police, thoroughly entertained the audience by delivering a wealth of insights and comedy moments from nearly 20 years on the beat. London Branch was grateful for the additional sponsorship provided by Messrs Corrpro, Correx, PPG, Steel Protection Consultancy, Telpro and Winn & Coales.

This thoroughly enjoyable event is due for a repeat in December 2015.
On 8th January 2015, London Branch began the New Year with a presentation at The Naval Club, Mayfair, on the corrosion protection of iconic London structures. Under the Chairmanship of John O’Shea, the presentation was given by David Deacon, corrosion consultant, past president of the ICorr and holder of a unique ICorr Lifetime Achievement Award.

David began his presentation by announcing that this was to be his last public presentation (probably), with retirement beckoning. He then took some moments to detail some of the more important events in the Life of The Institute which included, the publication of the DTI Hoar Report by Dr T P Hoar, ICorr President in 1969-70, the establishment of the CCEJV/CEA by Fred Palmer, ICorr President in 1982-83 and finally the purchase of Corrosion House under ICorr President John O’Shea 2000-02.

David identified an impressive list of iconic structures in and around London on which he had had involvement; with the first mentioned, the Barking Flood Barrier, being a protection failure. On this Barrier, David had discovered that the original protection system comprised a very porous aluminium metal sprayed layer with a poorly penetrating sealer and four further coats of a chlorinated rubber product. This coating system was originally mistakenly taken from a bridge specification and failure resulted in corrosion losses on the Barrier within 10 years of service.

As a complete antithesis of the Barking problems, David then highlighted a tremendous success on the Thames Barrier. Here the submerged steel gates were internally coated with a single hot applied solvent free epoxy system at 550 microns thickness and externally, a 4-coat, 500 micron coal tar epoxy system; both systems being selected from a 5-year testing programme. Even with the ever increasing use of the Barrier, these systems were well on course to show a 40 year success story.

Other iconic structures included in the presentation were the QEII M25 bridge, the Cutty Sark iron framework, the London Eye, the more recent Kings Cross Triplets project and not least Tower Bridge. In fact from his involvement on Tower Bridge, David showed 100 year old paint flakes removed from his inspection in 1994, made up of 28 separate paint layers. David then summarised the successful project as being one that employed approved ICATS registered & experienced contractors and experienced ICorr qualified inspectors.

On behalf of the 37+ attendees, a vote of thanks to David was given by ICorr Treasurer Dr Tony Collins; after which, all enjoyed the traditional hospitality of the London Branch.

Please refer to the ICorr website, for future Branch technical meetings at The Naval Club, 38 Hill Street W1J 5NS, 17.30 for an 18.15 start.
Having strayed into the rather esoteric world of corrosion and art in last month’s TT, I thought I’d continue with another aspect associated with aesthetic appreciation. However in a rather different sense. No longer is it the corrosion product that is pleasing. It is the metal itself! Gold is the first metal in this category. But interestingly it is not the most noble. The PGMs are in fact less easy to corrode than gold. Also PGMs are more likely to be helpful additions to other metals. They are of course expensive. So if they are going to be economically attractive then they will have to be added at very small levels (1% or less). But small additions can have dramatic effects - look what carbon does to iron. So what are the platinum group metals? They are generally taken to be ruthenium (Ru), rhodium (Rh), palladium (Pd), osmium (Os), iridium (Ir) and platinum (Pt). Early in my career I came across rhodium. I was working as a chemical analyst for the plating shop at Standards Telephone and Cables (STC) factory in North London. My job was to analyse all the solutions in the baths each week and oversee the required additions. There were a rhodium bath and a chromium bath as well as a gold bath. But the analysis method for rhodium gave trouble. So I was asked to devise (or at least find and apply) a better method. This I did. And got a small wage increase of five bob (25p) a week as a result! It is an interesting question why these metals do not corrode easily. It relates to their atomic structure certainly. But the concept of full shells (as occurs in the inert gases) is hardly relevant. Nor do oxide films play a major part. These metals are just inherently less prone to lose their outer electrons and why this is is something of mystery (at least to me!). There are conditions under which these metals will corrode. Just as gold will dissolve in aqua regia (three parts nitric acid to one part hydrochloric-I used this in the analysis of gold) so platinum will dissolve in concentrated hydrochloric acid to form the chloroplatinate ion. So what are the applications? Well jewellery and the electronics industry certainly. But what about the scientific side? Most corrosionists are familiar with the electrode properties of platinum. Its inertness makes it a good counter electrode. And the reproducibility of the oxygen reduction reaction on platinum makes it a useful pseudo reference electrode (also a good sensor for oxygen). No doubt the other PGM metals do this too. We are using gold and platinum in my lab as pseudo reference electrodes for a particular application and could be interested in cheaper alternatives among the PGMs (or by making additions of PGMs to quite inert materials such as copper). It helps to have a contact in South Africa (and I am lucky that I do- see picture) as this is where 75% of platinum and about 50% of the remaining PGMs can be found. Let’s look at a typical application where an addition of a PGM can be of help. This relates to the PCMs ability to act as an active cathode in an alloy. And hence push the potential up into the passive region for the alloy and retard the anodic (dissolution reaction). So small additions of a PGM to stainless steel generally improve its corrosion resistance, particularly in reducing acid environments. Whether they all improve pitting corrosion resistance is more open to question. Recent work has indicated that only ruthenium and osmium can be added to stainless steels without adversely affecting pitting tendency. Ruthenium is the least expensive metal among the PGMs and very recent work has concentrated on looking at its use in a stainless steel based coating. This is the area in which Dominique is working for her Masters project at the University of the Witwatersrand. So hopefully PGM’s will find increasing application in coatings and in alloys as small additions to improve some particular aspect of corrosion resistance. What else to talk about? Well the CED meeting in Aberdeen should be going ahead on 26th May (there should be a leaflet in this CM about it). Although working parties will meet there, it is possible there may be a prior England based meeting as well e.g. in coatings and the nuclear field. And then they will be reported at the main meeting in Aberdeen. Watch this space for more details on these. If you have ever been involved or would like to be involved in any of the CED working parties (coatings, nuclear, water treatment, monitoring, CP and concrete) then go to the website (www.icorr.org), find the CED pages and sign up. As usual any comments on this month’s TT get in touch with Douglas@harrbridge.freeserve.co.uk

Acknowledgement: Thanks are expressed to Dominique for her help with this article.

Effect of small additions of ruthenium on pitting resistance.
ICORR ABERDEEN NOVEMBER 2014 BRANCH MEETING- A PROJECT PERSPECTIVE TO GIRTH WELD QUALIFICATION IN SOUR ENVIRONMENTS

The November 2014 meeting was held at the Palm Court hotel. Ian Merchant of Technip who was also representing the Institute of Materials, Minerals & Mining (IOM3) was the guest speaker.

Ian gave a brief of IOM3 and Technip as institutions with an overview of activities. He covered the welding qualification including DNV OS F101 and ISO 15156 requirements with testing requirements/variables. He followed this with an explanation of the pipeline reeling process with emphasis on the effects on pipeline welds.

Ian touched on preparation of weld strings and went into some details on the preparation of test specimens touching on the different test geometries such as Full ring (root intact), Root Machined and Root Intact. With pictures and graphical representations, he explained the process and results from Four Point Bend (FPB) and Full Ring Loading tests.

He explained various techniques for weld qualification, complications of applying these test in real projects and use in prediction fatigue cracking of Reeled Pipe. He concluded his talk by stating that Carbon Steel (X65 and above) may qualify for sour service by suitable test methods while Corrosion Resistant Alloys (CRAs) could also qualify but he warned of potential impacts if sample preparation is not done properly.

A Question and Answer (QA) session was held after the meeting touching on various aspects of the presentation. For information about the Aberdeen branch activities please contact our branch secretary, Frances Chalmers, ICorrABZ@gmail.com. Alternatively a calendar of local events of interest to corrosion professionals in the Aberdeen area and the opportunity to sign up to the branch mailing list is available at https://sites.google.com/site/icorrabz/home.
The Institution of Corrosion launched the new ICorr Job Board in May last year. The Job Board enables you to find all of the best corrosion industry jobs in one place. At the time of writing we have 85 jobs being advertised for positions in the corrosion industry. The majority of these are based in the UK however there are also some overseas positions. Since its launch we have had 46 jobseekers register with the site. In addition, 1,742 people have looked at jobs with 22 applications being sent.

Visit www.icorr.org and click on the Job Board tab to:

- **Search for and quickly apply to great, relevant jobs**
- **Set up Job Alerts so you are immediately notified any time a job is posted that matches your skills or interests**
- **Create an anonymous job seeker profile or upload your anonymous CV so employers can find you**
- **Access job searching tools and tips**
- **Place your job in front of our highly qualified members**
- **Search our CV database of qualified candidates**
- **Manage jobs and applicant activity right on our site**
- **Limit applicants only to those who are qualified**
- **Fill your jobs more quickly with great talent**

Job seeking is always free, members and sustaining member companies enjoy a 15% discounts when posting jobs. To get your 15% discount please visit the member’s area of the website where you will find the discount code. Alternatively, you can contact our website administrator Jonathan Phillips on 0114 2730132 or jonathan@squareone.co.uk.

In order to keep members informed of all the latest jobs we will be publishing a monthly ‘Jobs of the Month’ email. If you would like to subscribe to this email you can send you email address to jonathan@squareone.co.uk or register for the ICorr website member’s area. We will also be publishing the jobs of the month on the Linked In Group.

Our hope is that this new resource will make a significant difference for our members as they navigate their career paths. Thank you for your ongoing support.
With the development of new industry sectors such as renewable energy, the focus on how corrosion knowledge is transferred has come under scrutiny. Mature industries such as oil and gas production have well established good practices, codes and standards to ensure compliance for the safe and efficient design and operation of assets.

- Are the tried and tested oil and gas guides and standards transferable to other industries?
- Are other industries guides and standards transferable to oil and gas?
- Are there opportunities for common guides and standards?
- How does the information learnt from one industry get transferred to another?
- Are lessons learned from operations being fed back into new designs to improve safety and reliability?

ICorr and NACE GB recognise that to improve safety and reliability in different industries there is a need to improve the flow of knowledge transfer between them. This workshop can be considered the start of this process. By bringing together delegates from diverse industries, case studies can be used to identify potential areas of commonality and the best routes for knowledge transfer.

**Workshop**

The aim of the workshop is to provide delegates with an understanding of how information flows within industries, and how they can take other industry practices and deploy them in their own fields. This can be within a project, within industry sector or across industries.

The presentations from internationally recognised leaders in the field, and in group discussions will endeavour to answer some of these questions by focusing on selected areas within the corrosion management disciplines.

**Workshop Chairman**

**George Winning**

George has been working in the corrosion sector for 27 years covering chemicals, corrosion and materials. He currently works for Premier Oil in London, working on the Sealion Project in the Falklands as the Senior Corrosion materials Engineer. He has been active with ICorr and NACE over the years and sits on the council of the Institute of Corrosion and is also the board of directors of the NACE Institute.

**Workshop Vice Chairman**

**Pat Stokes**

Pat is a Chartered Marketer with a degree in Applied Chemistry from the University of Portsmouth and a PhD in Corrosion Science and Engineering from UMIST. Pat has 25 years’ experience in the Oil and Gas and energy related industries and has worked for CAPCIS, Emerson, Bodycote and AMEC. He is a member of ICorr and CIM. He has specialist knowledge of materials testing, corrosion monitoring and corrosion management. He is currently Technical Sales Manager with MACAW Engineering Ltd.

**The Session Chairs**

**Don Harrop**

Don is currently director of his own independent consulting company (CorroDon Consulting Ltd) in the UK and a Visiting Professor at the University of Manchester in the School of Materials, having retired from BP at the end October 2011 after a 34 year career. During his time with BP Don worked variously in R&D, technology and central engineering finally as Upstream Engineering Technical Authority and Senior Advisor for materials & corrosion and chair of BP’s Upstream Innovation Board.

**Jon Gluyas**

Jon is a geologist with 28 years’ experience in the oil industry and more recently 5 years in academia. His interests are in all forms of geoenergy and CCS, the common link being fluid rock interactions in the deep subsurface. Jon

**Andrew Duncan**

Andy Duncan is a Chartered Engineer with a degree in Metallurgy and Materials Science from Nottingham University, and has been a practising Materials and Corrosion Engineer for over 30 years. He is a member of ICorr and IOMMM.

Andy has worked for BP, CAPCIS, Associated Octel, and The Health and Safety Executive where he led the KP4 programme on ageing and life extension of offshore installations. He recently joined Intertek Production & Integrity Assurance as Lead Consultant with responsibilities for asset integrity management of ageing hydrocarbon plant and equipment.

**Mike Surkein**

Michael Surkein has over 33 years’ experience with ExxonMobil as a Corrosion / Materials Specialist with a background in corrosion control, cathodic protection, coatings and linings, pipe coatings, inspection and material selection among other skills. Mike is currently the Senior Corrosion and Materials Consultant for ExxonMobil Development Company and acts as an advisor across all ExxonMobil Upstream Companies.

**George Winning**

George has been working in the corrosion sector for 27 years covering chemicals, corrosion and materials. He currently works for Premier Oil in London, working on the Sealion Project in the Falklands as the Senior Corrosion materials Engineer. He has been active with ICorr and NACE over the years and sits on the council of the Institute of Corrosion and is also the board of directors of the NACE Institute.

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started his career with BP before joining the independent sector culminating with founding two oil companies including current North Sea operator Fairfield Energy. Since joining Durham University in 2009, Jon has held the Head of Department in Earth Sciences and is now the Dean for Knowledge Exchange. Jon has also served the petroleum and academic sectors as President of the PESGB, President of the Earth Science Teachers Association and Chairman of the British Geological Survey.

Workshop Guidelines

Format
The workshop will consist of 2 days of informal discussions supported by presentations from leading Corrosion Engineers. The event is structured to encourage the exchange of ideas among delegates and presenters through the technical presentations followed by extended Question and Answer sessions.

There will also be student poster session with 10 posters being selected for a presentation at the workshop along with free attendance as well as a prize for the best poster.

Documentation
In order to encourage the exchange of ideas, including work in progress, new concepts, Joint Industry Projects and unpublished project work, there will be no formal handouts. We will be requesting that the speakers share their presentations where possible, however this will be at their discretion and therefore we do not guarantee copies of presentations will be available to take away. Being a workshop the participation and learning from your peers will be of more value than formal handouts.

Attendance
The workshop is aimed at Corrosion Engineers, Technologists, Safety Engineers, verification bodies and academics.

To facilitate the exchange of information and encourage involvement of all, the audience will be limited so delegates will be accepted on a first come first served basis. The workshop committee are encouraging an audience with a broad mix of regions, experience, and disciplines, so if you feel this would be a good event for you and you are willing to participate in the discussions we encourage you to book early.

We are also offering a number of places at a reduced rate to students.

To register please complete the registration form which is enclosed in this issue of Corrosion Management. Alternatively you can download the registration form from the Conferences and Events section of www.icorr.org.

Commercialism
In keeping with the ICorr and NACE principles, commercialism in the presentations will not be permitted and the chairman of each session will be vetting them for this.

The Venue
Royal Over-Seas League (ROSL)
The Royal Over-Seas League (ROSL) is a non-profit Commonwealth private members organisation, committed to supporting international understanding and friendship through social, music, arts and welfare activities. Adjoining Green Park in the heart of London’s West End, ROSL is an ideal central London venue, and offers delegates a graceful elegance, grandeur and comfortable venue.

Sponsorship Opportunities
There will be number of sponsorship opportunities for the workshop and details will be available soon, but if you would like to be notified before others please register your interest at admin@icorr.org.

The Committee
The committee for the workshop consists of number of leading names in the corrosion and materials industry.

George Winning
Premier Oil Exploration and Production Ltd.
Pat Stokes
MACAW Engineering Ltd.
Dr. John Broomfield
Broomfield Consultants
Andrew Duncan
Intertek Production & Integrity Assurance
Prof. Jon Gluyas
Durham University
Don Harrop
CorroDon Consulting Ltd.
Gemma Malthouse
AkzoNobel
David Mobbs
Wood Group Kenny Ltd.
Imma Mobbs
Independent
Trevor Osborne
Deepwater Corrosion Services (UK) Ltd.
Dr. Paulette Sidky
CMC Ltd.
Mike Surkein
ExxonMobil Development Company
Sarah Vasey
AkzoNobel
NEW SUSTAINING MEMBER
PPC LTD

PPC Ltd’s, management team have been in the industry since 1975 and 40 years on, under the PPC Ltd banner, have developed into an organisation providing blast cleaning, industrial painting and general painting and refurbishment works. Our management team have built a reputation for encompassing innovative ideas, working effectively and efficiently producing quality and high standards of workmanship required to meet our client’s needs. The company concentrates on Rail, Highways, M.O.D and London Underground as its main sectors although we have carried out many contracts and projects for a wide range of clients from outside these sectors, most recently The Royal Beach Hotel, whereby we have fully refurbished both externals and internals.

PPC Ltd are fully Health and Safety conversant and continually trained and monitored on a regular basis ensuring a professional job from commencement of works to completion, with procedures adhered to by our workforce and the regular training implemented in-house by our management.

We also have our own ICORR Paint Inspector and are registered members of construction line, ICORR and SSIP (Safety Schemes in procurement).

For further information contact: PPC Ltd., 10 Valiant Gardens, Hilsea, Portsmouth, Hampshire, PO2 9NZ
Tel: 023 92612405  email: enquiries@ppc-ltd.info  Website: ppc-ltd.info
The Yorkshire Branch of ICorr is strategically placed at the heart of Britain’s industrial heartland. This is a traditionally heavy engineering and manufacturing area based around the large cities of Leeds and Sheffield. Many of the traditional “heavy” industries have been replaced by sub assembly and hi tech ones but manufacturing and fabrication companies are still in evidence and alongside those are found a wide range of metal finishing companies attempting to combat corrosion.

One aspect as a result of our industrial decline is the rich industrial history we have been left with. Our region abounds with canal, river and railway structures, some disused, other brought up to modern day standards. Many of these we see during our daily lives such as the Humber Bridge and large railway stations.

The Yorkshire Branch of ICorr has always had both a valued core of sustaining members and also an active and highly respected committee, giving their time freely and helping to share their knowledge with others through technical talks, industrial visits and seminars. Over the last few years however some committee members have retired or through career changes cannot devote time to Branch activities this has had an impact on the activity of the branch and the lack of current events.

Past events included an annual post Xmas lunch, usually held towards the end of January to discuss the coming years events. Also regular “lunchtime” or afternoon meetings were held on a monthly or bi monthly basis to discuss future events, these usually being held at Argyll and Ruane in Rotherham, which is close to the M1.

It is our intention to reform the Yorkshire Branch committee and attain a dynamic following. Possible future events could include technical visits, industrial walks along rivers/ canals, social meetings, canal boat trips, etc.

Our first visit and meeting will be held on Thursday 21st May 2015 at Elcometer Limited, Manchester. This will include a tour of the manufacturing area and visual demonstrations of equipment. This will be followed by an Extraordinary General Meeting to reform the Yorkshire Branch committee.

Details regarding the above visit and meeting will be found on the ICorr website in due course and also in Corrosion Management.

For details on the above please contact myself at the address below.

*Nigel Peterson-White (Yorkshire Branch Secretary ICorr), Argyll and Ruane/IMechE, Meadowbank Road, Rotherham, S61 2NF.*

*Mobile: 07793 710559*

*Email: n_peterson-white@imeche.org*
1. Introduction

The monopile has been the most commonly used type of foundation for offshore windfarms. These large diameter steel piles, which are normally uncoated internally, are flooded with seawater when installed. Although nominally sealed from further ingress and egress of seawater, there is the potential for such seals becoming ineffective, leading to the possibility of corrosion of the internal surfaces due to the replenishment of oxygen. Accordingly, the application of cathodic protection (CP), in the form of galvanic (sacrificial) anodes, could be considered as a remedy to address such a situation in the event of it occurring.

In reality, the use of internal CP systems in monopiles is a relatively new development, for which there is no relevant guidance in existing offshore cathodic protection standards, and evidence has only recently begun to emerge that there may be disadvantages associated with the application of CP in enclosed spaces if particular secondary effects are not considered. Accordingly, a laboratory study, reported here, has been carried to elucidate the reactions taking place when galvanic anodes are applied to the protection of steel in enclosed spaces.

Further, the tests conducted explored also the possibility of augmenting the level of protection by using liquid membranes floated on the internal seawater/air interface to restrict oxygen exchange with the air above the waterline [to be used either with CP or as a stand-alone corrosion mitigation method], the effect of the presence of an internal tidal range and the use of aluminium and zinc anodes.

2. Test programme

Tests, simulating probable in-service anode to cathode area ratio, and cathode area to seawater volume, were carried out for the following conditions:

Test 1. Aluminium anodes with open seawater/air interface [no tidal replenishment]
Test 2. Zinc anodes with open seawater/air interface [no tidal replenishment]
Test 3. Aluminium anodes with gas impermeable membrane at seawater/air interface [no tidal replenishment]
Test 4. Zinc anodes with gas impermeable membrane at seawater/air interface [no tidal replenishment]
Test 5. Aluminium anodes with gas impermeable membrane at seawater/air interface [tidal replenishment simulated [10% volume replaced each ‘tide’]]

The work used fresh sea water collected from Anglesey coast.

2.1 Test set up

The laboratory test rig was designed to simulate, as far as possible, the internal environmental conditions within a monopile, including, but not limited to, the anode to cathode area ratio, cathode area to seawater volume, and seawater diameter to depth ratio. The cathode was a carbon steel plate, grit blasted to Sa2½ with a surface area of approximately 87550 mm². Two galvanic anode materials, aluminium-zinc-indium proprietary alloy and a zinc alloy to US MIL-A-18001 specification, with both having a surface area of 2500 mm², were evaluated. Fresh seawater was used as

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the test fluid, filling a HDPE pipe of 14” ID with a volume of 110L (water depth 1100mm). For tests 3, 4 and 5 the water/air interface was covered with a proprietary floating membrane impermeable to oxygen. For test 5, 10% of the seawater was withdrawn, and replaced with fresh, at regular intervals to simulate tidal replenishment.

The test assembly was designed to allow monitoring of the environmental changes produced as a result of the application of cathodic protection using galvanic anodes. Parameters, such as oxygen levels, pH, and accumulation of anode dissolution products were measured at intervals throughout the test duration. The design allowed for measurements, and water samples, to be taken at three elevations in the HDPE pipe, bottom, middle and top. The results presented herein are those taken at the centre elevation. At the end of the test the extent of calcareous scale formation on the steel, and its composition were also analysed. The scales were stable calcareous deposits comprising carbonate, magnesium hydroxide and constituents of the respective anode materials and sea water. The cathodic current was measured using a ZRA and the potentials were measured with respect to Ag/AgCl/sea water reference electrodes. These data were continuously logged. The water chemistry was analysed for Al, Zn and Fe using Flame Atomic Adsorption, and bicarbonate by titration to pH 4.5. Oxygen and pH were analysed in-situ using optical sensors. The pH was also measured for each water sample taken. All tests were preceded by a two week “pre corrosion” period to allow for corrosion products to form on the cathode steel plate. Thereafter, the seawater was exchanged with fresh seawater and the CP was initiated by coupling the anode to the cathode via a ZRA.

3. Results
3.1 CP potentials and current densities
Typical CP current densities and potentials for both anodes are exhibited in Figure 2. These data are from tests 1 and 2: very similar behaviour occurred in all tests. As can be seen from these graphs, the steel/seawater potentials with aluminium anodes were more negative than the zinc, as would be expected. However, it is also clear from the graphs, that the anode resistance in the test cells may have been overestimated resulting in excessive initial current output and steel/seawater potentials of the steel plates being more negative than ~1000mV vs Ag/AgCl/sw. To reduce the current and polarisation levels to those experienced in service, the circuit resistance between the anode and cathode was increased (by the addition of resistors) to allow the cathode potential to attain more realistic values. The final steel cathode current densities were greater for the aluminium anode (16.8mA/m²) than for the zinc anode (14.8mA/m²) at comparable steel/sea water cathode potentials (-896mV and 879mV respectively).

3.2 Water chemistry
3.2.1 pH
In tests 1 and 2 the water chemistry for both anodes changed with time. The most significant changes were in the pH of the seawater [Figure 3] which, for the aluminium anode, reduced from 7.8 to 5 after a couple of weeks and remained at this pH for the remainder of the test. The pH produced by the zinc anode test remained relatively constant between 7 and 8. Very similar changes in pH were observed with a membrane in place [tests 3 and 4], while 10% tidal replenishment [test 5] reduced the fall in pH produced by the aluminium anode to 6.

It is considered that the initial buffering capacity of the seawater was the reason for the delayed reduction in the pH observed in the aluminium anode tests. This was confirmed in a small scale laboratory test where AlCl₃ was added to seawater: at a concentration of 200mg/L of AlCl₃ the pH reduced suddenly and significantly to 4.7. This was not observed when ZnCl₂ was added to seawater. In this case, the pH reduced initially from 7.8 to 7.1 at 500mg/L of ZnCl₂: any further addition of ZnCl₂ did not affect the pH which remained more or less constant at pH7.

3.2.2 Oxygen
In tests 1 and 2 the oxygen concentration of the seawater reduced within the first two weeks from 9ppm (saturated with air) to 0.4ppm for the Al anode test and 2.5ppm for the Zn anode test [Figure 4]. The reason for this difference is the initial higher cathode current in the Al anode test and hence higher oxygen consumption at the cathode. After two weeks the oxygen levels rose in both tests to 4 - 5ppm, possibly due to thermal convection currents in the test cells allowing air absorption at the seawater surface. At the end of the tests, the oxygen concentration was ~4ppm in both tests. The presence of the membrane prevented this surface absorption of oxygen, with levels falling to the limit of detection in tests 3 and 4 [no replenishment] and stabilising at ~0.5ppm in the ‘tidal’ test.

3.2.3 Aluminium, zinc and bicarbonate
The concentration of both aluminium ions (in the case of the aluminium anode test) and zinc ions (in the case of the Zn anode test) initially increases as would be expected due to the liberation of both anions as the anodes dissolve, Figure 5. The Zn²⁺ ion concentration increased slowly as the test proceeded. However, the Al³⁺ concentration appears to reach a steady state concentration at 10mg/L after three weeks. In both tests, the bicarbonate concentration decreased within the first few weeks of the test. The bicarbonate levels in the electrolyte in the Al anode tests reached a steady state [10mg/L] after 2 weeks, whilst a steady state in the Zn anode test was reached in three weeks, at a much higher concentration [70mg/L].

4. Discussion
There are many interacting factors which affect the cathodic current densities and changes in the water chemistry caused by the application of cathodic protection. The described tests sought to clarify some of these factors with specific focus on CP systems using galvanic anodes in enclosed spaces. The tests clearly demonstrated a marked difference between the use of aluminium and zinc anodes, in particular in respect of pH. For aluminium, after an initial two weeks in which the pH hardly changed, a sudden reduction of the pH from pH 8 to pH 5 was noted. This also occurred in a small scale laboratory test where AlCl₃ was added to seawater: at a concentration of 200mg/L of AlCl₃ the pH reduced suddenly and significantly to 4.7. The sudden acidification (reduction of pH) also coincided with a low bicarbonate concentration, which reduced slowly at the start of the test but reached a steady state after three weeks into the test (10mg/L). A similar observation was made with regards to the aluminium ion concentration which initially increased and after about three weeks also reached a steady state (10mg/L). It is argued that aluminium hydrolysis is a main factor in reducing the pH which initially buffered by the bicarbonate within the seawater. On exhaustion of the bicarbonate, the pH reduced causing acidification of the seawater. Zinc anodes did not replicate this fall in pH.

While the use of a proprietary floating membrane impermeable to oxygen proved successful in reducing levels of oxygen, it had no significant effect on the formation of acid conditions within the test cells and its use may only provide beneficial under certain conditions and therefore should be
considered on a project by project basis. Tidal replenishment, to the extent tested, ameliorated the formation of acidity by aluminium anodes, but did not prevent it.

5. Conclusions

The following deductions from the laboratory study can be made in respect of optimising CP designs for offshore wind farm monopiles:

- If no seawater replenishment takes place and aluminium anodes are used, the increase of acidity [lowering of pH] will increase the cathode currents required for protection of the steel, increase the self-consumption rate of anodes and increase the rate of hydrogen evolution. It is possible that protection of the steel may not be maintained.

- Zinc anodes do not significantly alter the pH and will, therefore, not have the adverse consequences described for aluminium anodes in non-replenished conditions. They will also evolve less hydrogen than aluminium anodes.

- The use of a gas impermeable membrane to reduce oxygen exchange at the seawater surface does not change the pH variations due to CP effects in a non-replenished situation but is effective in reducing oxygen level in the water but its merits should be considered on a project by project basis.

- If tidal replenishment can be achieved, the pH may be maintained at levels close to those in natural seawater, depending on the percentage seawater exchange on each tide, and aluminium anodes may be used. However, care in the design of the flushing system is important to mitigate against the stratification of the water column; this could present problems of decreasing pH even if tidal replenishment is employed, in particular for those monopiles that were drilled and have deeper water columns below the sea bed.

6. Application of the data

Although the focus here is on the use for retrofit solutions, as most known applications have been in this configuration, the applicability of these findings is equally valid for designers considering internal anodes for new structures.

Two cathodic protection designs (based on Aluminium and Zinc anodes) informed by the results obtained in this test programme have been developed to maturity and the Zinc option further into detailed design level. This exercise has enabled an understanding of the key differences between the two materials, both in terms of performance but also the practical challenges posed by installation, cost and Health & Safety considerations.

Focusing on the system designed in detail, it would utilise cast galvanic anodes of Zinc to US MIL-A-18001 specification, cast onto steel bar cores. The anodes would be assembled together into ‘strings’. In this application strings consisting of ca. 50kg gross weight individual anodes [to facilitate ‘two man’ manual handling] spaced at ca. 1 metre spacings would be assembled offshore, within the TP, and suspended into the water filled MP.

Assessments have been made of the current/voltage attenuation down the anode strings and novel design steps have been taken to ensure that the currents delivered by anodes at all elevations are similar, such that the provision of current and the polarisation of the steel/seawater interface of the MP will be uniform as will be the life of the anodes. It is postulated that some anode string designs, not following these novel steps, will discharge higher currents and will suffer early anode depletion at the top of strings whereas lower elevations of MP may be inadequately protected and their anodes under-utilised.

The anode shape/dimensions have been determined that the current output should be close to the optimum for achieving steel/seawater potentials that stimulate the most protective calcareous deposits [in the range -930 to -1000mV Ag/AgCl/sw]; this is intended to ensure that any MIC would be controlled and the minimum current and maximum life delivered.

The generation of hydrogen at both the cathode and the anodes has been assessed and specialised venting would be an integral part of the system to prevent potentially explosive atmospheres forming above the water column in the MP and below the airtight deck of the TP.

For such a system, representative foundations should be monitored to ensure that the CP performance is properly assessed along with the sea water chemistry variations, in order that the design is fully verified. It is highly recommended that a small number of foundations are fitted with these detailed monitoring systems by way of a trial and that in any full implementation, lower cost, less detailed CP monitoring is implemented into a larger number but representative small proportion of the foundations.

It is intended to publish more details of the testing and the CP system design in the near future.

More generally, the data from this investigation and from related work by, and reviewed by, the authors should inform the wider application of cathodic protection to the internals of foundations. The following general conclusions can be drawn:

i. The reliance on oxygen depletion for corrosion control of the internals of monopiles achieves mixed results and needs to be considered on a project by project basis.

ii. The chemistry changes in non-replenished, closed systems have not been fully reported in the past. This is possibly because many fully closed CP systems have used Zinc anodes and the widespread internal CP application of Aluminium anodes has been in systems that are regularly replenished. These changes need to be addressed in foundation internal CP designs.

iii. Whilst the greater anode capacity (Amp Hours per kg) of Aluminium anodes makes them lighter and easier to install, and less costly, than Zinc anodes, the latter are a more secure choice if there is no, inadequate or uncertain replenishment of the sea water within monopile foundations.

iv. The laboratory study presents detailed and credible data to inform the design of internal CP systems for monopiles. As would be expected for a closed and non, or marginally, replenished systems, the steel cathode current density values for polarisation are much lower than the default design figures in offshore platform CP Standards and recommended practices which are often, wrongly, used as a basis for windfarm monopile CP designs.

v. The design of galvanic anodes strings for foundation monopile internal applications requires design steps that are not documented in existing standards. These include:

- the competent addressing of anode/anode and anode/monopile resistance within the string.
- assessment of anode/anode and anode/cathode mutual interaction that will reduce anode output from that calculated from classical resistance to remote anode calculation.
- the calculation of attenuation down anode strings and down monopile/transition pieces.
- the proper practice of casting anodes onto properly prepared steel core (do not cast aluminium onto galvanised steel cores, this results in exothermic dissolution of the iron/zinc intermetallics to the detriment of anode quality and foundry safety).
- the addressing of corrosion of the anode suspension system above the water level within the foundation.
It is self-evident that the windfarm offshore standards and Classification Society requirements permitted the original 'oxygen depletion' corrosion mitigation solution to be applied in many developments; these have proved difficult to achieve in practice. This work has shown that the existing Standards and codes which are widely used for the design of CP systems for offshore structures and monopile foundations have inadequacies in respect of the protection of internal [almost] closed compartments. It is strongly recommended that Standards Bodies and Classification Societies review and upgrade guidance to include internal areas considering the results discussed in this paper.

References

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Testing Performed- Wrap Outlasts Steel

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The following video shows application of Belzona SuperWrap II:

<table>
<thead>
<tr>
<th>Resin Grade</th>
<th>Resin Colour</th>
<th>Cure Temperature</th>
<th>Minimum Cure Time</th>
<th>[Return to Service]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belzona 1981</td>
<td>Blue</td>
<td>5°C &gt;10°C</td>
<td>48 Hours</td>
<td>24 Hours</td>
</tr>
<tr>
<td>Belzona 1982</td>
<td>Green</td>
<td>&gt;20°C</td>
<td>24 Hours</td>
<td></td>
</tr>
</tbody>
</table>

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Workplace training is carried out by ICATS certificated trainers who are qualified to train and assess operatives. Training is carried out in-house and may be undertaken by a certificated trainer employed by an ICATS registered training organisation. However it is more usual for registered companies to nominate experienced employees to ICATS for prior approval as company trainers. Subject to meeting the acceptance criteria, nominees attend a 2 day ICATS Company Trainer course held at various locations in the UK.

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</tr>
<tr>
<td>Possilpark Shotblasting Co Ltd</td>
<td>Dalmarnock Works, 73 Dunn Street, Glasgow, G40 3PE</td>
<td>0141 556 6221</td>
</tr>
<tr>
<td>Company Name</td>
<td>Address/Location</td>
<td>Phone Options</td>
</tr>
<tr>
<td>---------------------------------------------</td>
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</tr>
<tr>
<td>Pro Steel Engineering Ltd</td>
<td>48a Severnbridge Industrial Estate, Symondscliffe Way, Caldicot, Monmouthshire, NP26 5PW</td>
<td>T: 01291 424949</td>
</tr>
<tr>
<td>Radleigh Metal Coatings Ltd</td>
<td>Unit 30, Central Trading Estate, Cable Street, Wolverhampton, WV2 2HX</td>
<td>T: 01902 870606</td>
</tr>
<tr>
<td>R H Painting Limited</td>
<td>Alexander House, Monks Ferry, Birkenhead Wirral, CH41 SLH</td>
<td>T: 0870 7892020</td>
</tr>
<tr>
<td>R.L.P. Painting</td>
<td>Heathfield House, Old Bawtry Road, Finningley, Doncaster, DN9 3DD, UK</td>
<td>T: 01302 772222</td>
</tr>
<tr>
<td>SCA Group Ltd</td>
<td>Woolsbridge Ind. Park, Three Legged Cross, Dorset, BH2 1 FA</td>
<td>T: 01202 820820</td>
</tr>
<tr>
<td>Severn River Crossing Plc</td>
<td>Bridge Access Road, Aust, South Gloucestershire, BS35 4BD</td>
<td>T: 01454-633351</td>
</tr>
<tr>
<td>Sherwin-Williams Protective &amp; Marine Coatings</td>
<td>Tower Works, Kestor Street, Burton-on-Trent, Burton-upon-Trent, DE6 1JF</td>
<td>T: +44 (0) 1204 521771</td>
</tr>
<tr>
<td>Shirley Industrial Painters &amp; Decorators Ltd</td>
<td>Grand Union House, Bridge Walk, Acocks Green, Birmingham, B27 6SN</td>
<td>T: 0121 706 4000</td>
</tr>
<tr>
<td>Shutdown Maintenance Services Ltd</td>
<td>Kingsnorth Industrial, Hoo, Rochester, Kent, ME3 9ND</td>
<td>T: 01634 256969</td>
</tr>
<tr>
<td>Sitecote Ltd</td>
<td>33 Kielder Close, Ashton in Makerfield, Wignall, LN4 OJE</td>
<td>T: 07714678719</td>
</tr>
<tr>
<td>Solent Protective Coatings Ltd</td>
<td>Tredgear Wharf, Marine Parade Southampton, Hants, SO14 5JF</td>
<td>T: 02380 221480</td>
</tr>
<tr>
<td>South Staffs Protective Coatings Ltd</td>
<td>Bloomfield Road, Tipton, West Midlands, DY4 9EE</td>
<td>T: 0121 522 2373</td>
</tr>
<tr>
<td>Southern Coating Contractors Ltd</td>
<td>Malmsbury House, 227 Shirley Road, Shirley, Southampton, SO15 3HT</td>
<td>T: 0238 0702276</td>
</tr>
<tr>
<td>Specialist Blasting Services Ltd</td>
<td>Smiths Quay, Hazel Road, Woolston, SO19 7GB</td>
<td>T: 023 80438901</td>
</tr>
<tr>
<td>Specialist Painting Group Ltd</td>
<td>Unit 3 Propser House, Astore Park, Padholme Road East, Fange Road, Peterborough, PE1 5XL</td>
<td>T: 01773 309500</td>
</tr>
<tr>
<td>Stainless Restoration Ltd</td>
<td>Unit M1, Adamson Industrial Estate, Croft Street Hyde, Cheshire, SK14 1EE</td>
<td>T: 0161 3686191</td>
</tr>
<tr>
<td>Stamford Construction Limited</td>
<td>Barham Court Business Centre, Teston, Maidstone, Kent, MW18 5BZ</td>
<td>T: 07912037033</td>
</tr>
<tr>
<td>Standish Metal Treatment Ltd</td>
<td>Potter Place, West Pimbo, Skelmersdale, Lanchester, WN8 9PW, UK</td>
<td>T: 01695 455977</td>
</tr>
<tr>
<td>Stobbarts Ltd</td>
<td>Tarn Howe, Lakes Road, Derrington, Industrial Estate, Workington, Cumbria, CA14 3Y</td>
<td>T: 01900 870780</td>
</tr>
<tr>
<td>Story Contracting Ltd</td>
<td>Burgh Road Industrial Estate, Carlisle, Cumbria, CA2 7NA</td>
<td>T: 017730 764414</td>
</tr>
<tr>
<td>Stream Marine Training Ltd</td>
<td>Kintyre House, St Andrews Crescent, West Campus, Glasgow International Airport, Paisley, PA3 2TQ</td>
<td>T: 0141 212 8777</td>
</tr>
<tr>
<td>Tees Valley Coatings</td>
<td>Riverside Park Road, Middlesbrough, Cleveland, TS2 1UT</td>
<td>T: 01642 2258141</td>
</tr>
<tr>
<td>TMS Engineering Ltd</td>
<td>S-6 Curran Road, Cardiff, CF10 5DF, UK</td>
<td>T: 020920 344556</td>
</tr>
<tr>
<td>TMA Engineering Ltd</td>
<td>Tyneside Industrial Estate, Jarrow, NE11 9EZ</td>
<td>T: 0191 4932600</td>
</tr>
<tr>
<td>Tinsley Special Products</td>
<td>Enterprise House, Durham Lane, Eaglescliffe, Stockton-on-Tees TS16 0PS</td>
<td>T: 01642 784279</td>
</tr>
<tr>
<td>T I Protective Coatings</td>
<td>Unit 6, Lodge Bank, Crown Lane, Horwich, Bolton, Lancs, BL6 5HU</td>
<td>T: 01204 468080</td>
</tr>
<tr>
<td>Torishima Service Solutions Europe Ltd</td>
<td>Sunnyside Works Gartshirr Road Coatbridge MLS 2DJ</td>
<td>T: 0123642390</td>
</tr>
<tr>
<td>Transvac Systems Ltd</td>
<td>Monsal House, 1 Bramble way, Alfriston, Derbyshire, DE55 4RH</td>
<td>T: 01773 831100</td>
</tr>
<tr>
<td>Vale Protective Coatings Ltd</td>
<td>Building 152 - Langar North Industrial Estate, Harby Road, Langar, NG13 9HY</td>
<td>T: 01949 869784</td>
</tr>
<tr>
<td>Walker Construction (UK) Ltd</td>
<td>Park Farm Road, Folkestone, Kent, CT19 5DY</td>
<td>T: 01303 851111</td>
</tr>
<tr>
<td>Wardle Painters Ltd</td>
<td>Unit 5, Wimborne Building, Atlantic Way, Barry Docks, Glamorgan, CF63 3RA, UK</td>
<td>T: 01446 748620</td>
</tr>
<tr>
<td>Wescott Coatings &amp; Training Services Ltd</td>
<td>9b/9c Tyne Point, Shaftsbury Avenue, Simonside Industrial Estate, Jarrow, Tyne &amp; Wear, NE32 3UP</td>
<td>T: 0191 497 5550</td>
</tr>
<tr>
<td>W G Beaumont &amp; Son</td>
<td>Beaumont House, 8 Bernard Road, Romford RM7 0HX</td>
<td>T: 01708 749202</td>
</tr>
<tr>
<td>William Hare Ltd</td>
<td>Bradlesholve House, Bradsholme Road, Bury, Lancs, BL8 1JY, UK</td>
<td>T: 0161 609 0000</td>
</tr>
<tr>
<td>Wood Group Industrial Services Limited</td>
<td>Kirkstone House, St Osiers Road, Western Riverside Route, Gateshead, Wear, NE11 9EZ</td>
<td>T: 0191 4932600</td>
</tr>
<tr>
<td>Xervon Palmers Ltd</td>
<td>331 Charles Street, Royston, Glasgow, G21 2QA</td>
<td>T: 0141 5534040</td>
</tr>
</tbody>
</table>
DIARY DATES 2015

Thursday 12th February 2015
London Branch Meeting
Speaker: David Dore; 17th Century murder in the church – a forensic examination of an English Civil War crime
Venue: Naval Club, 38 Hill Street, London, 17.45 for 18.15 start

Monday 16th March - Friday 20th March 2015
Advanced Cathodic Protection
http://mobilityoilandgas.com/advanced-cathodic-protection/
Venues: London
Mobility Oil & Gas Petroleum Engineering, Consultancy & Technical Training Services. Upcoming Course.
Contact: +442030867082 or training@mobilityoilandgas.com

Monday 23rd February - Friday 27th April 2015
Advanced Cathodic Protection
http://mobilityoilandgas.com/advanced-cathodic-protection/
Venues: London
Mobility Oil & Gas Petroleum Engineering, Consultancy & Technical Training Services. Upcoming Course.
Contact: +442030867082 or training@mobilityoilandgas.com

Thursday 9th April 2015
London Branch joint meeting with NACE (GB)
Speaker: Geoff White; ‘Case study – measurement of line current as an aid to solving cathodic protection problems’
Venue: Naval Club, 38 Hill Street, London, 17.45 for 18.15 start

Tuesday 21st April - Friday 24th April 2015
Corrosion Control in the Oil and Gas Industry
Venues: Aberdeen
Mobility Oil & Gas Petroleum Engineering, Consultancy & Technical Training Services. Upcoming Course.
Contact: +442030867082 or training@mobilityoilandgas.com

Thursday 12th March 2015
London Branch meeting and AGM
Speaker: John Fletcher, ICorr President’s, ‘All in a day’s work’

Sunday 3rd May - Thursday 7th May 2015
Advanced Cathodic Protection
http://mobilityoilandgas.com/advanced-cathodic-protection/
Venue: Dubai
Mobility Oil & Gas Petroleum Engineering, Consultancy & Technical Training Services. Upcoming Course.
Contact: +442030867082 or training@mobilityoilandgas.com

Thursday 21st May 2015
Afternoon visit to Eclometer Limited and Reformation of ICorr Yorkshire
This will be a fascinating opportunity to visit the worldwide head office, manufacturing and research facility with a tour of the manufacturing and demonstration areas. This visit will be followed by an Extraordinary General Meeting to reform the ICorr Yorkshire Branch committee.
Venue: Eclometer Limited, Edge Lane, Manchester M43 6BU, 1.30pm - 5pm approx.
Contact: Nigel Peterson-White 07793 710559 npeterson-white@imeche.org

Tuesday 26th May 2015
CED Working Day and Symposium on Corrosion Aspects of Asset Integrity Management and Lifetime Extension
Venue: Palm Court Hotel, 81 Seafield Road, Aberdeen, AB15 7XY
www.thepalmcourthotel.com
To register please complete the enclosed leaflet.

Wednesday 10th June - Thursday 11th June 2015
Knowledge Transfer – Corrosion Matters Workshop
The aim of the workshop is to provide delegates with an understanding of how information flows within industries, and how they can take other industry practices and deploy them in their own fields. This can be within a project, within industry sector or across industries.
Venue: Royal Over-Seas League (ROSL), London
To register contact: admin@icorr.org

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